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Docket No.: 244151US8

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COMMISSIONER FOR PATENTS
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RE: Application Serial No.: 10/686,609
Applicants: Takeshi YAMASHITA, et al.
Filing Date: October 17, 2003
For: MOBILE STATION, MOBILE COMMUNICATION SYSTEM, AND CELL SELECTION METHOD
Group Art Unit: 2618
Examiner: Fayyaz Alam

SIR:

Attached hereto for filing are the following papers:

REQUEST FOR RECONSIDERATION
CERTIFIED ENGLISH TRANSLAITON OF JP 2002-304748
CERTIFIED ENGLISH TRANSLATION OF JP 2003-315652

Our check in the amount of **$0.00** is attached covering any required fees. In the event any variance exists between the amount enclosed and the Patent Office charges for filing the above-noted documents, including any fees required under 37 C.F.R 1.136 for any necessary Extension of Time to make the filing of the attached documents timely, please charge or credit the difference to our Deposit Account No. 15-0030. Further, if these papers are not considered timely filed, then a petition is hereby made under 37 C.F.R. 1.136 for the necessary extension of time. A duplicate copy of this sheet is enclosed.

Respectfully submitted,

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DOCKET NO: 244151US8

IN THE UNITED STATES PATENT & TRADEMARK OFFICE

IN RE APPLICATION OF	:
TAKESHI YAMASHITA, ET AL.	: EXAMINER: ALAM, FAYYAZ
SERIAL NO: 10/686,609	:
FILED: OCTOBER 17, 2003	: GROUP ART UNIT: 2618
FOR: MOBILE STATION, MOBILE COMMUNICATION SYSTEM, AND CELL SELECTION METHOD	:

REQUEST FOR RECONSIDERATION

COMMISSIONER FOR PATENTS
ALEXANDRIA, VIRGINIA 22313

SIR:

Responsive to the Official Action of July 17, 2007, Applicants respectfully request reconsideration of the rejections set forth therein.

In the outstanding Office Action, Claims 2-15 were rejected as being unpatentable over Wong et al. (WO 99/03290) in view Nishiyama et al. (US Patent No. 7,085,564); and Claims 4 and 7-9 were rejected as being unpatentable over Wong in view of Nishiyama and in further view of Korpela et al. (US Patent Application No. 2001/0031638).

All of the claims are rejected over prior art references that include Nishiyama. Nishiyama is not prior art with regard to the presently claimed invention. The effective prior art date of Nishiyama is February 25, 2003 which is after the filing date of Japanese Priority document JP 2002-304748. So as to perfect priority, Applicants file herewith an accurate translation of JP 2002-304748, which provides support for the claimed invention. For completeness, a translation of JP 2003-315652 is also filed herewith.

As Nishiyama is not prior art with regard to the presently claimed invention, Applicants respectfully request that the present application is in condition for formal allowance. A Notice of Allowance is earnestly solicited.

Respectfully submitted,

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VERIFICATION

The undersigned, of the below address, hereby certifies that he/she well knows both the English and Japanese languages, and that the attached is an accurate English translation of the Japanese Patent application filed on October 18, 2002 under No. P2002-304748.

The undersigned declares further that all statements made herein of his/her own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon.

Signed this 26th day of September, 2007.

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JAPAN PATENT OFFICE

This is to certify that the annexed is a true copy of the following application as filed with this Office.

Date of Application: October 18,2002

Application Number: Japanese Patent Application No.2002-304748

Applicant(s): NTT DoCoMo, Inc.

Commissioner,
Patent Office (Seal)

(Document Name) Patent Application
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(Presentation Date) October 18, 2002
(Directly) Commissioner of the Patent Office
(IPC) H04Q 7/22

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(Lists of the Article to be presented)

(Name of Article)	Specification	1
(Name of Article)	Drawing	1
(Name of Article)	Abstract	1

(Proof Reading) Required

【Document Name】 Specification

【Title of the Invention】

MOBILE STATION, MOBILE COMMUNICATION SYSTEM, AND CELL SELECTION METHOD

【Claims】

【Claim 1】

A mobile station comprising:

measuring means for measuring received levels of a serving cell and each neighboring cell thereto;

determining means for determining cell types of the current and neighboring cells; and

selecting means for selecting a cell as a reselection target, based on the received levels measured by the measuring means and the cell types determined by the determining means.

【Claim 2】

The mobile station according to Claim 1, wherein the selecting means changes a cell reselection condition, according to the cell type of the serving cell by the determining means.

【Claim 3】

The mobile station according to Claim 2, wherein the selecting means changes the cell reselection condition, according to the cell type of the neighboring cell determined by the determining means.

【Claim 4】

The mobile station according to Claim 1, comprising:

storing means for storing the cell types in relation with cell classes;

counting means for counting the number of reselections between cells

of different cell classes; and

changing means for changing the relation between the cell types and the cell classes in the storing means to another when the number of reselections counted by the counting means exceeds a predetermined value.

【Claim 5】

The mobile station according to Claim 4, wherein the changing means changes the relation between the cell types and the cell classes in the storing means to another when the number of reselections exceeds the predetermined value within a predetermined time from a point of a start of counting the number of reselections.

【Claim 6】

The mobile station according to Claim 4, wherein, on the occasion of changing the relation between the cell types and the cell classes, the changing means brings the relation back to that before the changing after a lapse of a predetermined time from a point of the changing.

【Claim 7】

The mobile station according to any of the preceding claims, wherein the cell types are information indicating that each cell is either an indoor cell or an outdoor cell.

【Claim 8】

A mobile communication system comprising:

the mobile station according to claim1; and

a base station for notifying the mobile station of information enabling identification of a cell type of its own cell or identification of cell types of its own cell and each neighboring cell thereto.

【Claim 9】

A cell selection method comprising:

a measuring step wherein measuring means of a mobile station measures received levels of a serving cell and each neighboring cell thereto;

a determining step wherein determining means of the mobile station determines cell types of the current and neighboring cells; and

a selecting step wherein selecting means of the mobile station selects a cell as a reselection target, based on the received levels measured by the measuring means and the cell types determined by the determining means.

【Claim 10】

The cell selection method according to Claim 9, wherein in the selecting step the selecting means changes a cell reselection condition, according to the cell type of the serving cell by the determining means.

【Claim 11】

The cell selection method according to Claim 10, wherein in the selecting step the selecting means changes the cell reselection condition, according to the cell type of the neighboring cell determined by the determining means.

【Claim 12】

The cell selection method according to Claim 9, comprising:

a counting step wherein counting means counts the number of reselections between cells of different cell classes; and

a changing step wherein changing means changes a relation between the cell types and the cell classes in storing means to another when the number of reselections counted by the counting means exceeds a predetermined value.

【Claim 13】

The cell selection method according to Claim 12, wherein in the

changing step the changing means changes the relation between the cell types and the cell classes in the storing means to another when the number of reselections exceeds the predetermined value within a predetermined time from a point of a start of counting the number of reselections.

【Claim 14】

The cell selection method according to Claim 12, wherein in the changing step, on the occasion of changing the relation between the cell types and the cell classes, the changing means brings the relation back to that before the changing after a lapse of a predetermined time from a point of the changing.

【Claim 15】

The cell selection method according to any of Claims 9, 10, 11, 12, 13 and 14, wherein the cell types are information indicating that each cell is either an indoor cell or an outdoor cell.

【Detailed Description of the Invention】

【0001】

【Field of the Invention】

The present invention relates to a mobile station, a mobile communication system, and a cell selection method.

【0002】

【Background Art】

Conventionally, when a mobile station selects a cell as a reselection target, the mobile station measures a received level of a signal from a base station currently under communication therewith or a base station of a cell where the mobile station is camped, and received levels from base stations of neighboring cells. The mobile station compares the received levels and

selects as a target cell a cell with the maximum received level from its base station, based on the result of the comparison (e.g., reference is made to Patent Document 1 and Patent Document 2).

【0003】

【Patent Document 1】 Japanese Patent No. 3233854

【Patent Document 2】 Japanese Patent No. 3315869 (p2 and Fig. 4)

【0004】

The conventional cell selection method will be briefly described below with reference to Fig. 1. As shown in Fig. 1, mobile station 10 is camped on a cell C0 established by base station B0, and cells C1, C2, and C3 exist as cells neighbor to the cell C0. Mobile station 10 receives broadcast information M0 from base station B0 to acknowledge the existence of neighboring cells C1, C2, and C3. The broadcast information M0 is transmitted and received through a common broadcast channel or through a control channel individually dedicated to mobile station 10.

【0005】

Mobile station 10 measures a received level L0 from base station B0, and received levels L1, L2, and L3 from the respective base stations B1, B2, and B3 forming the neighboring cells C1, C2, and C3. Thereafter, mobile station 10 compares the received level L0 with those L1, L2, and L3 and determines the propriety of a cell reselection. The comparison of the received levels is made, for example, using the following conditions (1) and (2).

【0006】

$$\max(Li) = \max(L1, L2, L3) \qquad (1)$$

$$\max(Li) > L0 + \Delta L \qquad (2)$$

Here max(argument 1, argument 2,...) represents a function that gives a maximum argument among argument 1, argument 2,... Furthermore, L0 indicates the received level of the serving cell and ΔL a reselection hysteresis value.

【0007】

When condition (2) becomes true, mobile station 10 selects a neighboring cell corresponding to max(Li) as a target cell and implements a reselection of the cell. On the other hand, when condition (2) does not become true, mobile station 10 implements no cell reselection.

【0008】

【Problem to be Solved by the Invention】

Cells are generally classified under indoor cells and outdoor cells, according to installation locations and surrounding environments of base stations. In general, the indoor cells have smaller radii than the outdoor cells, and the indoor environments have less disturbance factors than the outdoor environments; therefore, the indoor cells are expected to stabilize good communication quality. However, the cell selection in the aforementioned prior art involves no consideration to whether a cell as a candidate for a reselection target is an indoor cell or an outdoor cell. For this reason, the mobile station can fail to select a cell optimal for communication. For example, the cells are sometimes classified under three or more cell types like nanocells, macrocells, and microcells according to their cell radii.

【0009】

An object of the present invention is, therefore, to enable a mobile station to select a cell optimal for communication as a target cell, where the

cells are classified under multiple types.

【0010】

【Means for Solving the Problem】

In order to solve the above problem, a mobile station according to the present invention comprises measuring means for measuring received levels of a serving cell and each neighboring cell thereto; determining means for determining cell types of the current and neighboring cells; and selecting means for selecting a cell as a reselection target, based on the received levels measured by the measuring means and the cell types determined by the determining means.

【0011】

A cell selection method according to the present invention comprises a measuring step wherein measuring means of a mobile station measures received levels of a serving cell and each neighboring cell thereto; a determining step wherein determining means of the mobile station determines cell types of the current and neighboring cells; and a selecting step wherein selecting means of the mobile station selects a cell as a reselection target, based on the received levels measured by the measuring means and the cell types determined by the determining means.

【0012】

Here the selection of the target cell includes selection of a cell as a target candidate, of course, and also includes determination on the propriety of a reselection of the cell. Therefore, even if a cell as a target candidate is selected, where the cell is determined not to be an optimal cell as a reselection target, the mobile station can continuously camp in the current source cell without executing the candidate reselection of the cell.

【0013】

According to these aspects of the invention, the received levels of the serving cell and each neighboring cell thereto are measured, the cell types of the current and neighboring cells are determined, and thereafter the target cell is selected based on the received levels and the cell types. Namely, in the selection of the target cell including the determination on the propriety of the reselection, the mobile station selects the cell while taking into account not only the received levels in the current and neighboring cells, but also attributes of the respective cells. For example, the mobile station selects as a target cell an indoor cell classified in the cell type of the high received level. Since the indoor cell has the high received level and can stabilize good communication quality at the mobile station, the reselection of the selected cell permits the mobile station to perform low-power and high-speed communication. Namely, the selection of the target cell based on the received levels and the cell types enables the mobile station to select the cell optimal for communication.

【0014】

In the mobile station according to the present invention, preferably, the selecting means changes a cell reselection condition, according to the cell type of the serving cell by the determining means.

【0015】

In the cell selection method according to the present invention, preferably, the selecting step is configured so that the selecting means changes a cell reselection condition, according to the cell type of the serving cell by the determining means.

【0016】

According to these aspects of the invention, the cell reselection

condition is changed according to the cell type of the serving cell. For example, where the mobile station is now camped on an indoor cell, the continuous residence in the serving cell is more likely to stabilize good communication quality, rather than where the mobile station stays in an outdoor cell. In this case, therefore, the condition for the cell reselection is set tight to restrain the reselection so that no reselection is carried out unless a better cell is present in the surrounding area. As a consequence, it becomes feasible for the mobile station to select a cell optimal for communication as a target cell.

【0017】

In the mobile station according to the present invention, preferably, the selecting means changes a cell reselection condition, according to the cell type of the neighboring cell determined by the determining means.

【0018】

In the cell selection method according to the present invention, preferably, the selecting step is configured so that the selecting means changes a cell reselection condition, according to the cell type of the neighboring cell determined by the determining means.

【0019】

According to these aspects of the invention, the cell reselection condition is changed according to the cell type of the neighboring cell. For example, where the neighboring cell as a candidate for the target cell is an indoor cell, the reselection of the mobile station thereto is more likely to stabilize good communication quality, than where the neighboring cell is an outdoor cell. In this case, therefore, the condition for the reselection of the cell is loosed so as to promote the reselection of the better cell. As a

consequence, it becomes feasible for the mobile station to select the cell optimal for communication as a target cell.

【0020】

The mobile station according to the present invention, more preferably, comprises storing means for storing the cell types in relation with cell classes; counting means for counting the number of reselections between cells of different cell classes; and changing means for changing the relation between the cell types and the cell classes in the storing means to another when the number of reselections counted by the counting means exceeds a predetermined value.

【0021】

The cell selection method according to the present invention, more preferably, comprises a counting step wherein counting means counts the number of reselections between cells of different cell classes; and a changing step wherein changing means changes a relation between the cell types and the cell classes in storing means to another when the number of reselections counted by the counting means exceeds a predetermined value.

【0022】

According to these aspects of the invention, the cell types are stored in relation with the cell classes in the storing means and the number of reselections between cells of different cell classes is counted. When the number of reselections exceeds the predetermined value, the relation between cell types and cell classes is changed. These aspects of the invention are presented for clearing the concern that highly frequent reselections can cause discontinuation of data transmission to decrease the data transmission rates to the mobile station. When the number of reselections exceeds the

predetermined value, it is determined that the frequency of reselections of the mobile station is too high, and the relation (correspondence) between cell types and cell classes is changed to another.

【0023】

This results in, for example, changing the cell class of indoor cells having belonged heretofore to a priority cell class, into a nonpriority cell class and changing the cell class of outdoor cells having belonged heretofore to the nonpriority cell class, into the priority cell class. Namely, the cell classes are changed. In conjunction with the change of the cell classes, the conditions for the cell reselection also change to make the condition for the cell reselection tight even in the case where the mobile station is camped on an outdoor cell. Therefore, the frequency of cell reselections is restricted, thereby eliminating the concern of the decrease in the data transmission rates to the mobile station.

【0024】

In the mobile station according to the present invention, more preferably, the changing means changes the relation between the cell types and the cell classes in the storing means to another when the number of reselections exceeds the predetermined value within a predetermined time from a point of a start of counting the number of reselections.

【0025】

In the cell selection method according to the present invention, more preferably, the changing step is configured so that the changing means changes the relation between the cell types and the cell classes in the storing means to another when the number of reselections exceeds the predetermined value within a predetermined time from a point of a start of counting the

number of reselections.

【0026】

According to these aspects of the invention, the changing of the relation between cell types and cell classes is limited to cases where the number of reselections exceeds the predetermined value within the predetermined time from the point of the start of counting. Namely, where the predetermined time has elapsed after the time of initializing the number of cell reselections, the number of reselections is again initialized to 0, regardless of the number of reselections at that point. This makes the changing of the relation and, besides, the determination on the cell reselection more properly reflect the number of cell reselections (the frequency of cell reselections) within the predetermined time.

【0027】

In the mobile station according to the present invention, more preferably, the changing means is configured so that, on the occasion of changing the relation between the cell types and the cell classes, the changing means brings the relation back to that before the changing after a lapse of a predetermined time from a point of the changing.

【0028】

In the cell selection method according to the present invention, more preferably, the changing step is configured so that, on the occasion of changing the relation between the cell types and the cell classes, the changing means brings the relation back to that before the changing after a lapse of a predetermined time from a point of the changing.

【0029】

According to these aspects of the invention, where the relation

between cell types and cell classes is changed to another, the changed relation is brought back to that before the changing after a lapse of the predetermined time from the changing point. Namely, after the relation after the changing is maintained for the predetermined time from the starting point when the relation between cell types and cell classes was changed, the relation between cell types and cell classes is forcedly brought back to that before the changing. This permits the relation before the changing to be used again for the determination on the cell reselection, where the frequency of cell reselections becomes lower after the changing of the cell classes than before.

【0030】

In the mobile station according to the present invention, as described previously, the cell types are, for example, information indicating that each cell is either an indoor cell or an outdoor cell.

【0031】

In the cell selection method according to the present invention, the cell types are, for example, information indicating whether each cell is either an indoor cell or an outdoor cell.

【0032】

A mobile communication system according to the present invention comprises the above-stated mobile station; and a base station for notifying the mobile station of information enabling identification of a cell type of its own cell or identification of cell types of its own cell and each neighboring cell thereto.

【0033】

According to the present invention, the mobile station can determine the cell types of the respective cells (e.g., whether or not an indoor cell) as to

the current and neighboring cells, based on the above information notified of by the base station. The mobile station selects the target cell with reference to the determination result and the received levels, whereby it can select the cell optimal for communication.

【0034】

【Embodiments of the Invention】

One embodiment of the present invention will be described below in detail with reference to the drawings.

【0035】

Fig. 2 is a conceptual diagram showing a configuration of a mobile communication system in the invention. As shown in Fig. 2, mobile communication system 100 is comprised of mobile station 1, base station B10, base stations B11-B13, and base stations B21-B22. Mobile station 1 is camped on cell C10 established by base station B10. Cells C11, C12, and C13 established by the respective base stations B11, B12, and B13 exist as indoor cells neighbor to cell C10, and cells C21 and C22 established by the respective base stations B21 and B22 exist as outdoor cells neighbor to cell C10. In Fig. 2, the indoor cells are indicated by dashed lines and the outdoor cells by chain lines.

【0036】

Base station B10 notifies mobile station 1 of information indicating that cells C11-C13 and cells C21, C22 exist as neighboring cells and, in addition thereto, information (identification information) enabling identification of each cell, either an indoor cell or an outdoor cell (corresponding to a cell type). Namely, base station B10 notifies the mobile station 1 of broadcast information M1 containing the identification

information indicating the cell type of its own cell C10, the identification information indicating that the neighboring cells C11-C13 are indoor cells, and the identification information indicating that the neighboring cells C21, C22 are outdoor cells.

【0037】

The system may also be configured as follows: base station B10 notifies mobile station 1 of the information that cells C11-C13 and cells C21, C22 are present as neighboring cells, and the identification information indicating that its own cell C10 is either an indoor cell or an outdoor cell, and the base stations forming the respective cells notify the mobile station of the identification information indicating the cell types of the respective neighboring cells C11-C13, C21, and C22.

【0038】

The mobile station as a principal component of the mobile communication system according to the present invention will be detailed below. Fig. 3 is a block diagram showing a functional configuration of mobile station 1. As shown in Fig. 3, mobile station 1 is provided with at least broadcast information receiving part 2, received level measuring part 3 (corresponding to the measuring means), cell class determining part 4 (corresponding to the determining means), target cell selecting part 5 (corresponding to the selecting means), cell reselection part 6, number-of-reselections counting part 7 (corresponding to the counting means), and cell class changing part 8 (corresponding to the changing means).

【0039】

Broadcast information receiving part 2 receives the broadcast information M1 via a radio channel from base station B10 establishing the

serving cell C10 of mobile station 1. The broadcast information M1 contains the identification information indicating the cell type of cell C10, of course, and also contains the identification information indicating the cell types of cells C11-C13, C21-C22 neighbor to cell C10.

【0040】

Received level measuring part 3 measures the received levels of the respective cells C10, C11-C13, C21-C22, based on the broadcast information M1 received by broadcast information receiving part 2. This results in measuring the received levels of all the cells to which mobile station 1 can reselect.

【0041】

Cell class determining part 4 determines the cell class of serving cell C10 with reference to after-described cell class table 41 (corresponding to the storing means). The cell class is information as an index for mobile station 1 to determine a cell in which it is preferentially camped, and a condition for a cell reselection of mobile station 1 becomes tight where the cell class is a priority cell class than where the cell class is a nonpriority cell class.

【0042】

Fig. 4 (a) is an illustration showing a configuration example of cell class table 41. As shown in Fig. 4 (a), cell class table 41 has cell type region 41a and cell class region 41b. Cell type region 41a stores as "cell type," information indicating that the serving cell of mobile station 1 is either an indoor cell or an outdoor cell. Cell class region 41b stores as "cell class," information indicating that a cell of each corresponding cell type is either the priority cell class or the nonpriority cell class. Since the cell classes are correlated in one-to-one correspondence with the cell types in this way, the

determination on the cell class at mobile station 1 equals indirect determination on the cell type.

【0043】

The initial setting of the cell classes at a start of mobile station 1 is such that the indoor cells are classified under the priority cell class and the outdoor cells under the nonpriority cell class, but the information can be updated according to necessity. The details will be described later, but it is also possible to adopt such a configuration that when the number of reselections between cells of different cell classes exceeds a predetermined threshold (e.g., 5 or so), mobile station 1 changes the cell classes in the cell class region 41b, for example.

【0044】

Target cell selecting part 5 selects a target cell of mobile station 1, based on the received levels of the respective cells measured by received level measuring part 3 and the cell classes of the respective cells determined by cell class determining part 4. The selection of the target cell herein includes the determination on the propriety of the cell reselection itself, and even in the case where the target cell is selected, the reselection of that cell does not always have to be executed.

【0045】

Target cell selecting part 5 performs the selection of the target cell with reference to reselection hysteresis value table 51. Fig. 5 is an illustration showing a configuration example of reselection hysteresis value table 51. As shown in Fig. 5, reselection hysteresis value table 51 stores $\Delta L(1)$, $\Delta L(2)$, and $\Delta L(3)$ as first to third reselection hysteresis values. The above reselection hysteresis values of three steps are numerals satisfying the relation of $\Delta L(1) <$

$\Delta L(2) < \Delta L(3)$.

【0046】

$\Delta L(1)$ is used for comparison of received levels between the serving cell belonging to the nonpriority cell class and a neighboring cell belonging to the priority cell class. $\Delta L(1)$ is, for example, approximately −3 dB.

【0047】

$\Delta L(2)$ is used for comparison of received levels between the serving cell and a neighboring cell, where the serving cell and neighboring cell both belong to the same cell class. $\Delta L(2)$ is, for example, approximately 6 dB. It is a matter of course that $\Delta L(2)$ may take on different values according to whether the serving cell belongs to the priority cell class or not. In this case, the reselection hysteresis values are set in totally four steps.

【0048】

$\Delta L(3)$ is used for comparison of received levels between the serving cell belonging to the priority cell class and a neighboring cell belonging to the nonpriority cell class. $\Delta L(3)$ is, for example, approximately 9 dB.

【0049】

Cell reselection part 6 executes the cell reselection where the target cell is selected by target cell selecting part 5 and where the reselection of that cell is determined. The cell reselection means a change of the base station as a source of the broadcast information received by mobile station 1. Cell reselection part 6 outputs a reselection notification indicating completion of the cell reselection, to number-of-reselections counting part 7. This reselection notification contains information indicating whether or not the cell reselection notified of is between cells belonging to different cell classes.

【0050】

Number-of-reselections counting part 7 counts the number of reselections between cells belonging to different cell classes, according to the reselection notification from cell reselection part 6. Number-of-reselections counting part 7 retains a cell reselection threshold Nth as a criterion for determination on changing of the cell classes and always monitors the magnitude relation between the number of reselections counted and the cell reselection threshold Nth. When the number of reselections becomes larger than the cell reselection threshold Nth, the number-of-reselections counting part 7 instructs cell class changing part 8 to perform changing of the cell classes.

【0051】

When cell class changing part 8 is instructed to change the cell classes by number-of-reselections counting part 7, it accesses cell class table 41 to change the relation between the cell types and the cell classes to another. Namely, cell class changing part 8 sets the nonpriority cell class in the cell class region 41b in which the priority cell class has been set heretofore, and also sets the priority cell class in the cell class region 41b in which the nonpriority cell class has been set heretofore. As a consequence, as shown in Fig. 4 (b), the cell classes are changed in the cell class table 41.

【0052】

The operation of the mobile communication system will be described below. In conjunction therewith, each of steps in the cell selection method according to the present invention will also be described. Fig. 6 is a flowchart for explaining the cell reselection determining process executed by mobile station 1.

【0053】

First, broadcast information receiving part 2 of mobile station 1 receives the broadcast information M1 from base station B10 of the serving cell (S1).

【0054】

Received level measuring part 3 measures each of the received level L10 from base station B10 and the received levels L11-L13, L21, L22 from base stations B11-B13, B21, B22 of the respective neighboring cells, with reference to the broadcast information M1 received from base station B10 (S2).

【0055】

Subsequently, cell class determining part 4 determines to which cell class, either the priority cell class or the nonpriority cell class, the serving cell C10 belongs, with reference to cell class table 41 (S3).

【0056】

When the result of the determination is that the serving cell C10 is an outdoor cell, since it belongs to the nonpriority cell class, target cell selecting part 5 selects a target cell on the basis of the result of the comparison between the received level of the serving cell and the received levels of neighboring cells belonging to the priority cell class. Specifically, target cell selecting part 5 selects the target cell, using conditions (3), (4) below.

【0057】

$$\max(Li(1)) = \max(L11, L12, L13) \qquad (3)$$

$$\max(Li(1)) > L0 + \Delta L(1) \qquad (4)$$

Here max(argument 1, argument 2,...) represents a function that gives a maximum argument out of argument 1, argument 2,... Moreover, L0 indicates the received level of the serving cell and ΔL(1) the first reselection

hysteresis value as described above. In addition, Li(1) indicates a received level of a neighboring cell belonging to the priority cell class.

【0058】

When condition (4) becomes true (S4; Yes), target cell selecting part 5 selects a neighboring cell corresponding to max(Li(1)) as a target cell and instructs cell reselection part 6 to implement the reselection of the cell. In the next process, the cell reselection part 6 thus instructed to perform the cell reselection makes mobile station 1 reselect the cell selected at S4 (S6). After completion of the reselection, the sequential reselection determining process ends.

【0059】

In contrast to it, when condition (4) does not become true(S4; No), the flow moves to the process of S5.

【0060】

At S5, target cell selecting part 5 compares the received level of the serving cell with the received levels of the neighboring cells belonging to the same nonpriority cell class as the serving cell, and selects the target cell on the basis of the result of the comparison. Namely, target cell selecting part 5 selects the target cell, using condition s (5), (6) below.

【0061】

$$\max(Li(2)) = \max(L21, L22) \qquad (5)$$

$$\max(Li(2)) > L0 + \Delta L(2) \qquad (6)$$

Here max(argument 1, argument 2,...) represents a function that gives the maximum argument out of argument 1, argument 2,... Moreover, L0 indicates the received level of the serving cell and ΔL(2) the second reselection hysteresis value as described above. Furthermore, Li(2) indicates a received

level of a neighboring cell belonging to the nonpriority cell class.

【0062】

When the result of the determination is that condition (6) becomes true (S5; Yes), target cell selecting part 5 selects a neighboring cell corresponding to max(Li(2)) as a target cell and instructs cell reselection part 6 to make a reselection of the cell. At S6, cell reselection part 6 instructed to implement the cell reselection makes mobile station 1 reselect the cell selected at S5. After completion of the reselection, the sequential reselection determining process ends.

【0063】

In contrast to it, when condition (6) does not become true (S5; No), the cell reselection determining process is terminated without execution of the cell reselection.

【0064】

The following will describe the processing executed when the result of the determination process at S3 is that the serving cell belongs to the priority cell class. Target cell selecting part 5 compares the received level of the serving cell with the received levels of the neighboring cells belonging to the same priority cell class as the serving cell, and selects a target cell on the basis of the result of the comparison.

【0065】

Namely, target cell selecting part 5 selects the target cell, using conditions (7), (8) below.

【0066】

$$\max(Li(1)) = \max(L11, L12, L13) \qquad (7)$$

$$\max(Li(1)) > L0 + \Delta L(2) \qquad (8)$$

When condition (8) becomes true (S7; Yes), target cell selecting part 5 selects a neighboring cell corresponding to max(Li(1)) as a target cell, and instructs cell reselection part 6 to implement a reselection of the cell. Subsequently, cell reselection part 6 instructed to perform the cell reselection makes mobile station 1 reselect the cell selected at S7 (S6). After completion of the reselection, the sequential reselection determining process ends.

【0067】

In contrast to it, when condition (8) does not become true (S7; No), the flow moves to the process of S8.

【0068】

At S8, target cell selecting part 5 compares the received level of the serving cell with the received levels of the neighboring cells belonging to the nonpriority cell class, and selects a target cell on the basis of the result of the comparison. Namely, target cell selecting part 5 selects the target cell, using conditions (9), (10) below.

【0069】

$$\max(Li(2)) = \max(L21, L22) \qquad (9)$$

$$\max(Li(2)) > L0 + \Delta L(3) \qquad (10)$$

As described previously, $\Delta L(3)$ indicates the third reselection hysteresis value.

【0070】

When the result of the above determination is that condition (10) becomes true (S8; Yes), target cell selecting part 5 selects a neighboring cell corresponding to max(Li(2)) as a target cell, and instructs cell reselection part 6 to implement a reselection of the cell. Next, cell reselection part 6 instructed to perform the cell reselection makes mobile station 1 reselect the

cell selected at S8 (S6). After completion of the reselection, the sequential reselection determining process ends.

【0071】

In contrast to it, when condition (10) does not become true (S8; No), the cell reselection determining process is terminated without execution of the cell reselection.

【0072】

In mobile communication system 100, as described above, mobile station 1 executes the cell reselection determining process, thereby adopting the different cell reselection conditions between where the serving cell belongs to the nonpriority cell class and where the serving cell belongs to the priority cell class. Specifically, where the serving cell belongs to the nonpriority cell class, mobile station 1 is camped on an outdoor cell, and thus the lower reselection hysteresis value is used than where the serving cell belongs to the priority cell class. This looses the reselection condition from the outdoor cell and increases the percentage of mobile station 1 leaving the outdoor cell. In other words, where the serving cell belongs to the priority cell class, mobile station 1 is camped on an indoor cell, the higher reselection hysteresis value is used than where the serving cell belongs to the nonpriority cell class. This makes the reselection condition from the indoor cell tight and increases the percentage of mobile station 1 staying in the indoor cell.

【0073】

Independent of to which cell class the serving cell belongs, mobile station 1 employs the different cell reselection conditions for the neighboring cells belonging to the priority cell class and for the neighboring cells belonging to the nonpriority cell class. Specifically, since a neighboring cell belonging

to the priority cell class is an indoor cell, mobile station 1 uses the lower reselection hysteresis value in the selection of the target cell in that case than in the case of a neighboring cell belonging to the nonpriority cell class. This looses the reselection condition to the indoor cell and increases the percentage of mobile station 1 reselecting the indoor cell. In other words, since a neighboring cell belonging to the nonpriority cell class is an outdoor cell, mobile station 1 uses the higher reselection hysteresis value in that case than in the case of a neighboring cell belonging to the priority cell class. This makes the reselection condition to the outdoor cell tight and keeps low the percentage of mobile station 1 reselecting the outdoor cell.

【0074】

Namely, mobile station 1 adaptively changes the target cell, depending upon the surrounding environment including the serving cell. This results in selecting a neighboring cell with higher communication stability as a target cell, whereby mobile station 1 can perform stable communication with the base station. As a result, mobile station 1 becomes able to perform low-power and high-speed communication.

【0075】

The above cell reselection determining process was described on the assumption that the cell classes were only two types, the priority and nonpriority, and that the cell types were only two types, the indoor cells and outdoor cells. However, the target cell selection technology according to the present invention is also applicable to cases where the cell classes and cell types each are M species (M is an integer not less than 3); for example, a case where the cell classes are three species, priority 1, priority 2, and priority 3 and where the cell types are three species, nanocells, microcells, and

macrocells. Fig. 7 is a flowchart showing the cell reselection determining process as a generalized example including such cases. The present cell reselection determining process includes steps common to the cell reselection determining process which was described with reference to Fig. 6, and thus the corresponding steps will be denoted by the same series of step numbers (with the same last numbers), without redundant description of the same steps. Specifically, S11, S12, and S16 in Fig. 7 are equivalent to S1, S2, and S6, respectively, shown in Fig. 6.

【0076】

The steps specific to the present example will be described below.

【0077】

After completion of the processes of S11 and S12, cell class determining part 4 makes reference to the cell class table (not shown) in which M cell types are correlated with M cell classes, and identifies a cell class k (k is an integer from 1 to M) to which the serving cell belongs, based on the cell type included in the broadcast information (S13).

【0078】

The class k of the serving cell is an integer not less than 1 nor more than the number M of cell classes and cell types. It is assumed herein that value 1 of k indicates the highest priority.

【0079】

At S14, cell class determining part 4 substitutes "1" as an initial value into counter n (n is a natural number) for identifying a cell class of a neighboring cell.

【0080】

At S15, target cell selecting part 5 performs a selection of a target cell

on the basis of the received level of the serving cell and the received levels of neighboring cells. Specifically, target cell selecting part 5 selects the target cell, using conditions (11), (12) below.

【0081】

$$\max(Li(n)) = \max(Ln1, Ln2, ..., Lnm) \qquad (11)$$

$$\max(Li(n)) > L0 + \Delta L(nk) \qquad (12)$$

Here Ln1-Lnm are cells neighbor to the serving cell C10, and indicate the received levels of the cells Cn1-Cnm the cell type of which belongs to the cell class n. The received levels used herein are the values measured at S12. Furthermore, max(Li(n)) is a function that gives the maximum received level value out of Ln1-Lnm. L0 indicates the received level of the serving cell C10, and ΔL(nk) indicates a reselection hysteresis value used in the level comparison between the received level L0 of the serving cell and the received levels Ln1-Lnm of the neighboring cells belonging to the cell class n, where the serving cell belongs to the cell class k. For example, when the number of cell classes is M, there exist the square of M of reselection hysteresis values like ΔL(11), ΔL(12),..., ΔL(1M), ΔL(21),..., ΔL(2M),..., ΔL(MM).

【0082】

For example, in the case of M = 3,

ΔL(MM) = 3, 3, 6; 3, 6, 9; 6, 9, 12.

There are the nine reselection hysteresis values, and the reselection hysteresis values are set in totally (2M - 1) steps. It is a matter of course that the reselection hysteresis values can be set in an arbitrary number of steps according to the configuration of cells or the like.

【0083】

If cell class 1 is a cell class with the highest priority and if the

following relations exist among the reselection hysteresis values:

$$\Delta(1k) < \Delta(2k) < \ldots < \Delta(Mk) \qquad (13)$$

$$\Delta(n1) < \Delta(n2) < \ldots < \Delta(nM) \qquad (14),$$

the reselection condition is loosed more to the cell belonging to the cell class with the higher priority, and the reselection condition is made tight to the cell belonging to the cell class with the lower priority.

【0084】

For example, in the case of $k = 2$ and $n = 1$, the conditions equivalent to aforementioned conditions (3), (4) are used and the process equivalent to S4 in Fig. 6 is executed.

【0085】

At S15, when condition (12) becomes true (S15; Yes), target cell selecting part 5 selects a neighboring cell corresponding to max(Li(n)) as a target cell, and instructs cell reselection part 6 to implement a reselection of the cell. In the next process, cell reselection part 6 instructed to perform the cell reselection makes mobile station 1 reselect the neighboring cell selected at S15 (S16). After completion of the reselection, the sequential reselection determining process is terminated.

【0086】

In contrast to it, when condition (12) does not become true (S15; No), the flow proceeds to the process of S17 described below.

【0087】

At S17, cell class determining part 4 determines whether $n = M$, i.e., whether the counter n for distinguishing the cell class of the neighboring cells used in the reselection determination reaches the number M of cell classes. When the result of the determination is that n reaches M (S17; Yes), mobile

station 1 terminates the sequential reselection determination process without execution of the cell reselection from the serving cell C10.

【0088】

On the other hand, when the result of the determination at S17 is that n is still below M, i.e., $n < M$ (S17; No), the flow shifts to S18. At S18, cell class determining part 4 adds 1 to the current counter n, to set $n = n + 1$. After completion of this process, the flow returns to S15 and the processes at and after S15 are again executed.

【0089】

Namely, since the previous process of S15 resulted in selecting no target cell from the neighboring cells Cn1-Cnm belonging to the cell class n, S15 at this time is carried out again to attempt to select a target cell out of neighboring cells C(n+1)1-C(n+1)m belonging to the cell class (n+1) with the priority lower than that of the cell class n.

【0090】

As the sequential processes of S15-S18 are repeatedly executed, the reselection hysteresis value $\Delta L(nk)$ used for the selection of the target cell by mobile station 1 is successively updated in the named order of $\Delta L(1k)$, $\Delta L(2k)$,..., $\Delta L(Mk)$ until the counter n for distinguishing the cell class of the neighboring cell reaches the number M of cell classes and cell types. Even if the counter n is equal, the reselection hysteresis value $\Delta L(nk)$ is set at values different depending upon the cell class k to which the serving cell C10 belongs. Therefore, mobile station 1 can properly change the cell reselection condition according to the cell class k of the serving cell C10. As described previously, the cell classes k are set based on the cell types. Accordingly, in the case where the cell classes are classified in three or more species as in the

present example, it also becomes feasible to change the cell reselection condition according to the cell type of the serving cell C10.

【0091】

In the cell reselection determination process described with reference to Fig. 6, mobile station 1 was configured to implement the cell reselection with the higher priority on the indoor cells belonging to the priority cell class than on the outdoor cells belonging to the nonpriority cell class, and the cell reselection determination process of this type involves the concern that frequent cell reselections occur between cells belonging to different cell classes (for example, between indoor cells and outdoor cells). Such concern becomes prominent, particularly, in the case where mobile station 1 moves at high speed in the vicinity of the marginal territory of the serving cell, for example. Let us consider a situation in which the frequency of cell reselections becomes excessively high in the case where the indoor cells are classified under the priority cell class and the outdoor cells under the nonpriority cell class, and a solution thereto will be described below.

【0092】

Fig. 8 is an illustration schematically showing a configuration of a mobile communication system wherein mobile station 1 is camped on a cell different from that in the above example. As shown in Fig. 8, base station B31 establishes an outdoor cell C31, and base stations B41, B42, B43 their respective indoor cells C41, C42, C43. In Fig. 8, the indoor cells are represented by dashed lines, and the outdoor cell by a chain line. In the present embodiment, mobile station 1 is camped on at least the outdoor cell C31, and near the marginal territory of the outdoor cell C31, it moves back and forth between location A and location B through a path indicated by solid

arrows Y1.

【0093】

Fig. 9 shows a state in which the received levels from the respective base stations vary according to locations of mobile station 1 under the above situation. In Fig. 9, the locations of mobile station 1 are defined on the horizontal axis, and the received levels from the base stations B31, B41-B43 according to the locations of mobile station 1 on the vertical axis. The solid lines indicated by L31, L41-L43 show respective states in which the received levels from the base stations B31, B41-B43 vary with displacement of mobile station 1. Mobile station 1 always stays in the outdoor cell C31, while entering and leaving each of the indoor cells C41-C43. Therefore, the range of variation of the received level L31 is small, and those of L41-L43 are large.

【0094】

Therefore, if mobile station 1 executes the foregoing cell reselection determination process under the condition that the indoor cells belong to the priority cell class and the outdoor cell to the nonpriority cell class, cell reselections will be carried out at a total of six positions, P1-P6 as shown in Figs. 8 and 9. Such highly frequent reselections can induce degradation of quality of links and increase in the control load on the system and possibly impede stable communication between the mobile station and the base station. It is thus desirable to restrain the frequency of cell reselections by some means according to necessity.

【0095】

With reference to Fig. 9, it is anticipated that cell reselections will occur because of the frequent change in the magnitude relation between the received level L31 and the received levels L41-L43. For this reason, an

effective means for suppressing the frequent cell reselections is to increase the threshold of the received level L31 as a criterion to determine the propriety of cell reselections. By defining the received level of L31 + ΔL(3) as a threshold as indicated by the dashed line, the threshold always becomes greater than the received levels L41-L43, regardless of the rapid variation of the received levels L41-L43. In this case, no cell reselection occurs during the process in which mobile station 1 moves between the locations A, B.

【0096】

In order to increase the received level as the above threshold, a conceivable method is, for example, a technique of changing the cell classes. Namely, the indoor cells are classified under the nonpriority cell class and the outdoor cells under the priority cell class, as in the cell class table 41 shown in Fig. 4 (b). This results in changing the reselection hysteresis value, which is used in the determination on the reselection from cell C31 into one of cells C41-C43, from ΔL(1) to ΔL(3). Since ΔL(3) > ΔL(1) as described previously, L31 + ΔL(3) becomes larger than L31 + ΔL(1), so as to decrease the frequency of cell reselections.

【0097】

The cell class changing process executed by mobile station 1 will be described below as an example of the processing for restraining the highly frequent cell reselections, with reference to Fig. 10.

【0098】

The operation will be described on the premise that the cell class changing process is a process independent of the aforementioned cell reselection determination process and can also be executed in parallel with the cell reselection determination process, of course. The cell class changing

process is initiated at the timing of a start of mobile station 1.

【0099】

First, number-of-reselections counting part 7 substitutes "0" as an initial value into the number N of cell reselections of initialize and retain the number of cell reselections (T1).

【0100】

Number-of-reselections counting part 7 always monitors input of a reselection notification. When detecting input of a reselection notification from cell reselection part 6, it determines whether mobile station 1 has reselected between cells belonging to different cell classes, based on the reselection notification (T2).

【0101】

When the result of the determination is that the cell reselection was carried out (T2; Yes), number-of-reselections counting part 7 adds an increment of "1" to the number of cell reselections, to set $N = N + 1$ (T3).

【0102】

At T4, number-of-reselections counting part 7 compares the number N of cell reselections at the present time with the reselection threshold Nth to determine the magnitude relation. When the result of the comparison satisfies the relation of $N > Nth$ (T4; Yes), the flow shifts to T5 and cell class changing part 8 changes the cell classes presently stored in cell class region 41b. Specifically, the nonpriority cell class is set as a cell class corresponding to the cell type of indoor cells, and the priority cell class as a cell class corresponding to the cell type of outdoor cells.

【0103】

On the other hand, when the result of the comparison at T4 does not

satisfy the relation of N > Nth (T4; No), it is determined that the frequency of cell reselections is still not too high to require the changing of cell classes, and the flow returns to T2. Then number-of-reselections counting part 7 repeatedly executes the processes of T2-T4 before N exceeds Nth.

【0104】

When the number N of cell reselections exceeds the reselection threshold Nth and when the changing of the cell classes at T5 is completed, the flow moves to T1 to again initialize the number N of cell reselections and then repeatedly execute the processes at and after T1.

【0105】

The changing operation of the cell classes to which the respective cells C31, C41-C43 belong, results in making the serving cell C31 of mobile station 1 belong to the priority cell class and making the neighboring cells C41-C43 to mobile station 1 belong to the nonpriority cell class. Therefore, the cell reselection determination process is executed using $\Delta L(3)$ as a reselection hysteresis value in the comparison of the received levels at mobile station 1 in Fig. 8 (cf. S8 in Fig. 6). If the change of the cell classes is not carried out, $\Delta L(1)$ will be continuously used. Since $\Delta L(3) > \Delta L(1)$, the change of the cell classes makes the cell reselection condition tight, and decreases the frequency of cell reselections due to the temporal variation of the received levels of the neighboring cells C41-C43.

【0106】

In the mobile communication system 100, as described above, mobile station 1 is preferably configured to count the number of changes in the cell class of the serving cell due to cell reselections on a historical basis and change the relation between the cell types and the cell classes when it determines that

reselections between cells of different cell classes are too frequent. By autonomously changing the classifications of the cell classes according to the activity and the surrounding environment of the mobile station 1 in this way, it becomes feasible to increase the received level threshold as a criterion to determine the propriety of cell reselections. This restrains the frequency of cell reselections. As a consequence, it becomes feasible to decrease or suppress the discontinuation of data transmission due to the cell reselections and thus increase the throughput of the system, while decreasing the control load due to the cell reselections.

【0107】

It is noted that the modes described in the present embodiment are just the preferred examples of the mobile communication system according to the present invention and that the present invention is by no means intended to be limited to the above modes.

【0108】

For example, a potential configuration is such that a timer T01 (not shown) is started at the same time as the initialization of the number of cell reselections (cf. T1 in Fig. 10) and when the elapsed time indicated by the timer T01 reaches a predetermined time (e.g., about ten minutes), the reselection counter N is initialized, regardless of the value of the reselection counter N at that point. This process can limit the condition for the change of the cell classes to cases where the number of cell reselections between cells belonging to different cell classes exceeds the threshold Nth within the above predetermined time. Accordingly, it becomes feasible to execute the cell reselection determination based on the frequency of cell reselections calculated more precisely. Such condition setting is effective particularly in

application to cases where mobile station 1 moves back and forth in the same path at high speed.

【0109】

A further potential configuration is such that a timer T02 (not shown) is started at a point where the relation between the cell types and the cell classes is changed from the initial setting (cf. T5 in Fig. 10) and if the relation different from the initial setting is continued until the elapsed time of the timer T02 reaches a predetermined time (e.g., about five minutes), the relation is forcedly brought back to the initial setting. This configuration permits the relation of the initial setting to be used again for the determination on cell reselections in the case where the cell classes are once changed and thereafter the frequency of cell reselections becomes lower than before. As a consequence, it is feasible to prevent the relation different from the initial setting from being continuously used even during periods in which the degree of necessity for use of the relation different from the initial setting is low.

【0110】

【Effects of the Invention】

According to the present invention, the mobile station can select the cell optimal for communication as a reselection target.

【Brief Description of the Drawings】

【Fig. 1】 Fig. 1 is a configuration diagram for explaining the conventional cell selection method.

【Fig. 2】 Fig. 2 is an illustration schematically showing the overall configuration of the mobile communication system in the first embodiment.

【Fig. 3】 Fig. 3 is a block diagram showing the functional

configuration of the mobile station in the first embodiment.

【Fig. 4】 Fig. 4 (a) is a diagram showing a data storage example inside the cell class table before the changing of the cell classes. Fig. 4 (b) is a diagram showing a data storage example inside the cell class table after the changing of the cell classes.

【Fig. 5】 Fig. 5 is a diagram showing a data storage example inside the reselection hysteresis value table.

【Fig. 6】 Fig. 6 is a flowchart for explaining the cell reselection determination process.

【Fig. 7】 Fig. 7 is a flowchart for explaining a generalized example of the cell reselection determination process.

【Fig. 8】 Fig. 8 is an illustration for explaining the cell arrangement and movement path with high frequency of cell reselections by the mobile station.

【Fig. 9】 Fig. 9 is a diagram showing the magnitude relation among the received levels of the respective cells, which varies with time according to locations of the mobile station.

【Fig. 10】 Fig. 10 is a flowchart for explaining the cell class changing process.

【Explanation of Reference Numerals】

1···mobile station, 2···broadcast information receiving part, 3···received level measuring part, 4···cell class determining part, 5···target cell selecting part, 6···cell reselection part, 7···number-of-reselections counting part, 8···cell class changing part, B10, B31···current source base station, B11-B13, B21-B22, B41-B43···target base station, C10···current source cell, C11-C13, C41-C43···indoor cell, C21-C22, C31···outdoor cell, 100···mobile

communication system.

【Document Name】 Abstract

【Abstract】

【Problem】 A mobile station selects the cell optimal for communication as a reselection target.

【Means of Solution】 In mobile communication system 100 according to the present invention, mobile station 1 is camped on cell C10 established by base station B10. In the cell C10, there exist indoor cells C11-C13 and outdoor cells C21, C22 as neighboring cells. Mobile station 1 measures received levels of cells C10-C13, C21, C22 and determines cell types of the respective cells, i.e., whether each cell is an indoor cell or not, based on broadcast information M1. Mobile station 1 selects a cell as a reselection target on the basis of the received levels and cell types.

【Selected Drawing】 Fig.2

Fig.1

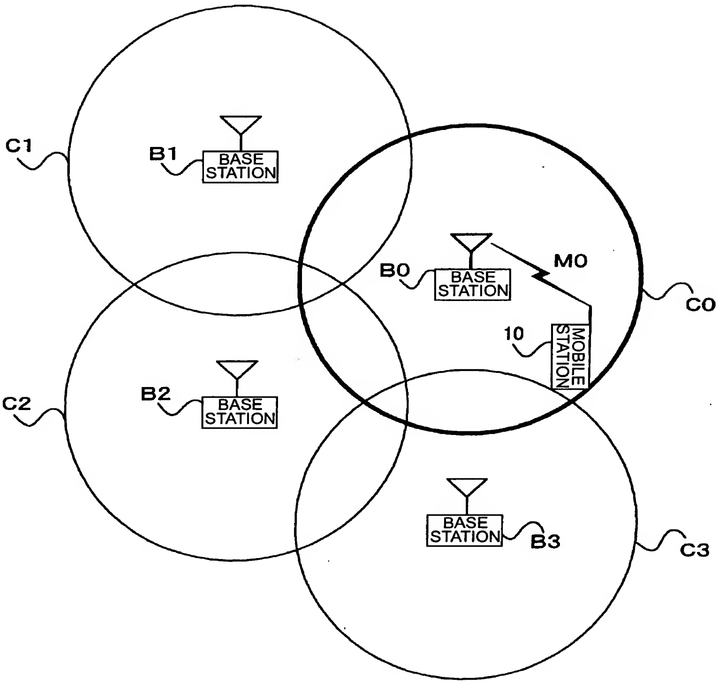
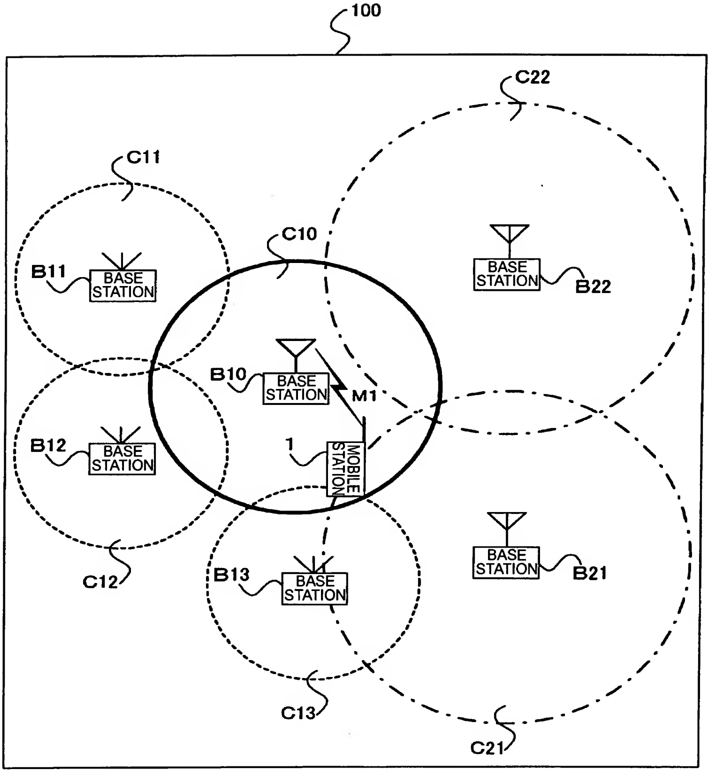

C1
B1
BASE STATION
B0
BASE STATION
M0
C0
10
MOBILE STATION
C2
B2
BASE STATION
BASE STATION
B3
C3

Fig.2



100
C22
C11
C10
B11
BASE STATION
BASE STATION
B22
B10
BASE STATION
M1
B12
BASE STATION
1
MOBILE STATION
BASE STATION
B21
B13
BASE STATION
C12
C13
C21

Fig.3

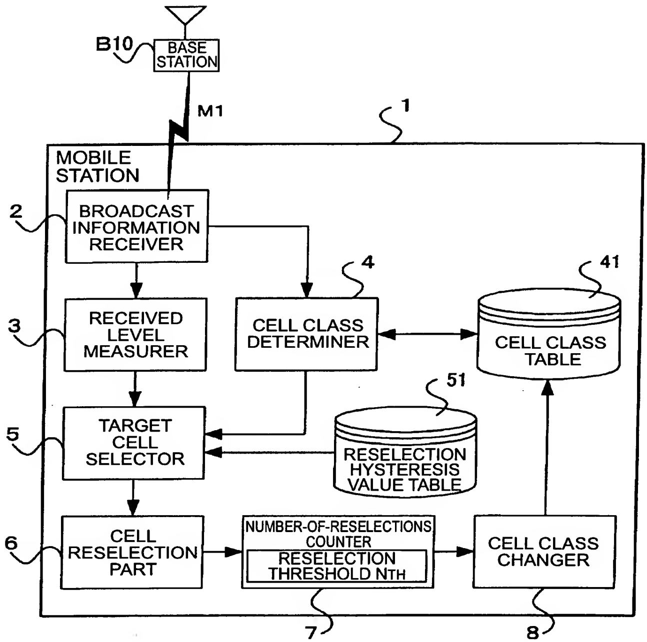

B10
BASE STATION
M1
1
MOBILE STATION
2
BROADCAST INFORMATION RECEIVER
3
RECEIVED LEVEL MEASURER
4
CELL CLASS DETERMINER
41
CELL CLASS TABLE
51
5
TARGET CELL SELECTOR
RESELECTION HYSTERESIS VALUE TABLE
6
CELL RESELECTION PART
NUMBER-OF-RESELECTIONS COUNTER
RESELECTION THRESHOLD NTH
CELL CLASS CHANGER
7
8

Fig.4

(a)

41

CELL TYPE (41a)	CELL CLASS (41b)
INDOOR CELL	PRIORITY CELL CLASS
OUTDOOR CELL	NONPRIORITY CELL CLASS

(b)

41

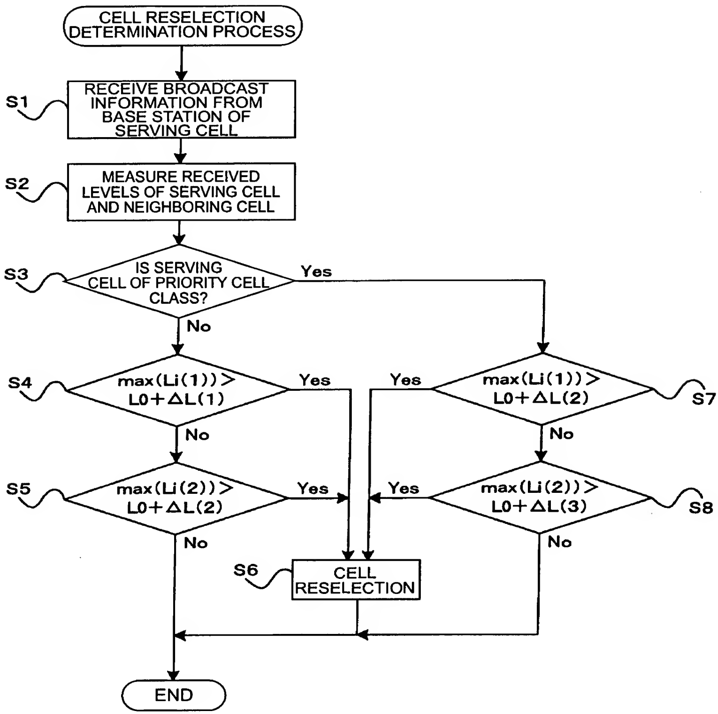
CELL TYPE (41a)	CELL CLASS (41b)
INDOOR CELL	NONPRIORITY CELL CLASS
OUTDOOR CELL	PRIORITY CELL CLASS

Fig.5

51

FIRST RESELECTION HYSTERESIS VALUE	ΔL(1)
SECOND RESELECTION HYSTERESIS VALUE	ΔL(2)
THIRD RESELECTION HYSTERESIS VALUE	ΔL(3)

Fig.6



CELL RESELECTION DETERMINATION PROCESS
S1
RECEIVE BROADCAST INFORMATION FROM BASE STATION OF SERVING CELL
S2
MEASURE RECEIVED LEVELS OF SERVING CELL AND NEIGHBORING CELL
S3
IS SERVING CELL OF PRIORITY CELL CLASS?
Yes
No
S4
max(Li(1))> L0+ΔL(1)
Yes
No
S5
max(Li(2))> L0+ΔL(2)
Yes
No
S7
max(Li(1))> L0+ΔL(2)
Yes
No
S8
max(Li(2))> L0+ΔL(3)
Yes
No
S6
CELL RESELECTION
END

Fig.7

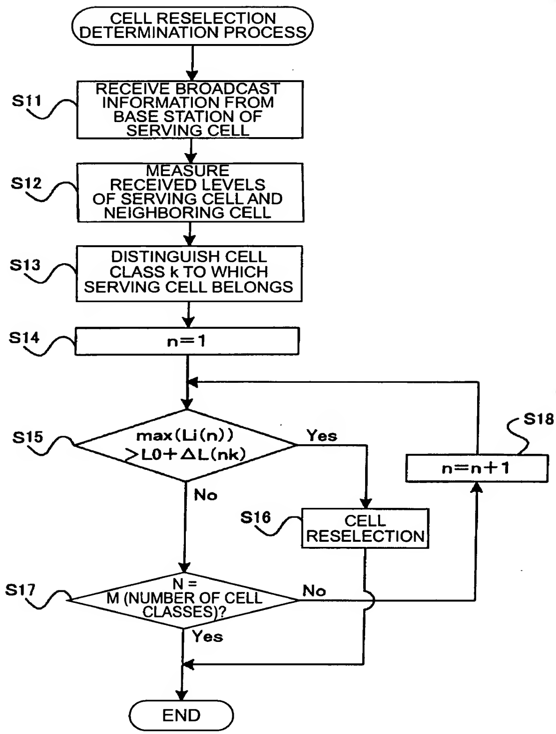
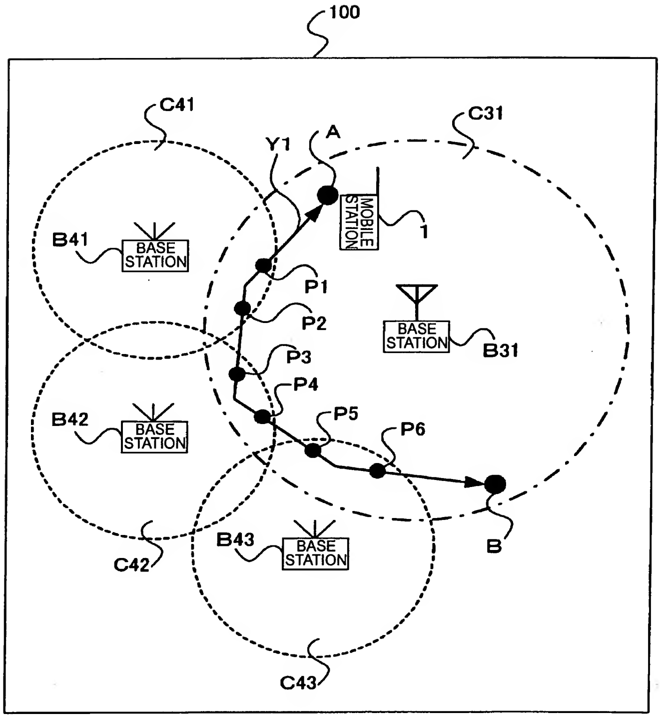
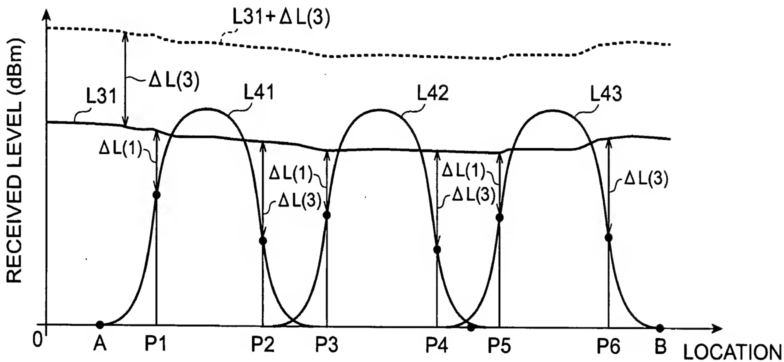

CELL RESELECTION DETERMINATION PROCESS
S11
RECEIVE BROADCAST INFORMATION FROM BASE STATION OF SERVING CELL
S12
MEASURE RECEIVED LEVELS OF SERVING CELL AND NEIGHBORING CELL
S13
DISTINGUISH CELL CLASS k TO WHICH SERVING CELL BELONGS
S14
n=1
S15
max(Li(n)) >L0+ΔL(nk)
Yes
No
S16
CELL RESELECTION
S17
N = M (NUMBER OF CELL CLASSES)?
No
Yes
S18
n=n+1
END

Fig.8



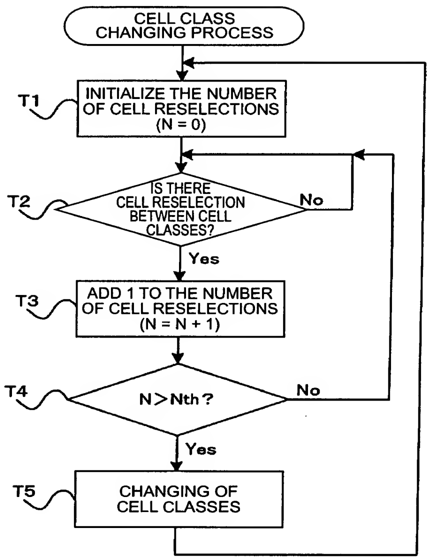
100
C41
C31
Y1
A
MOBILE STATION
1
B41
BASE STATION
P1
P2
BASE STATION
B31
P3
P4
B42
BASE STATION
P5
P6
B43
BASE STATION
B
C42
C43

Fig.9



RECEIVED LEVEL (dBm)
L31+ΔL(3)
ΔL(3)
L31
L41
L42
L43
ΔL(1)
ΔL(1)
ΔL(3)
ΔL(1)
ΔL(3)
ΔL(3)
0
A
P1
P2
P3
P4
P5
P6
B
LOCATION

Fig.10


CELL CLASS
CHANGING PROCESS
T1
INITIALIZE THE NUMBER
OF CELL RESELECTIONS
(N = 0)
T2
IS THERE
CELL RESELECTION
BETWEEN CELL
CLASSES?
No
Yes
T3
ADD 1 TO THE NUMBER
OF CELL RESELECTIONS
(N = N + 1)
T4
N>Nth?
No
Yes
T5
CHANGING OF
CELL CLASSES